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for

IMPROVED TRAMPOLINE MAT AND METHOD OF MAKING SAME

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BACKGROUND OF THE INVENTION

1. The Field of the Invention

[0001] The present invention relates to trampoline mats. More specifically, embodiments of the present invention relate to a sewn or non-sewn trampoline mat that distributes a load to a frame using a filament.

2. The Related Technology

[0002] Trampolines are well known devices used for bouncing, jumping and performing other acrobatic maneuvers. Trampolines are often used for entertainment, exercising, or athletic training.

[0003] Many versions of trampolines exist. A typical trampoline has a mat attached to a frame using coil springs. The springs support the mat and give the trampoline its resilient characteristics. Of course other resilient mechanisms have bean used in place of coil springs, such as elastic straps.

[0004] Trampolines are often subject to substantial wear and tear. In particular, the mat of a trampoline is generally subject to the most wear. Thus, the mat of a trampoline is often the first component of the trampoline to fail. The mat can be subject to wear and tear from users and items placed on the trampoline. For instance a users shoes, toys, clothing, and the like can potentially damage the mat. In addition, weather conditions such as temperature and UV light significantly affect the durability of trampoline mats used outdoors.

[0005] A trampoline mat is usually constructed as a single piece; therefore, when one portion fails, the entire mat fails. To create a bouncing surface the mat is created such that a force applied to the center of the mat is transferred radially to the springs.

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The springs exert a force on the mat to keep the mat suspended above the ground, for example. Consequently, when a tear or hole is made in the mat, the tear or hole tends to expand quickly. If the damage is not repaired the entire mat may fail. For the forgoing reasons, enhancing the durability of the trampoline mat is an effective mechanism to enhance the durability of the trampoline.

[0006] Existing mats are often constructed from polypropylene because of its high strength, relatively lightweight, and UV resistance. However, existing trampoline mats are constructed using other materials and structural features, which are likely to fail. For instance, most trampoline beds are hemmed or stitched to provide an attachment place for coil springs. Various mechanisms have been used to secure an attachment location for coil springs and the like. For instance, some trampolines have grommets crimped into the mat near its edge, while other mats use elastomers or webbing extending from the mat.

[0007] Sewing a stitch into the mat creates defined areas of stress in the mat. Over time, the areas of higher stress are more likely to fail, which reduces the durability of the mat. Furthermore, the localized attachment cites for springs creates bias in the weave of the bed fabric. The bias is created in the fabric around each spring attachment site. The fabric stretches non-uniformly to transfer the resilient force across the mat. The bias force absorbed by the fabric reduces the bounce and distributes a non-uniform force across the mat.

[0008] Using various materials to provide attachment sites for the springs also decreases durability of the mat. When multiple materials are used to make the trampoline mat, some materials will likely deteriorate faster than other materials. For

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instance, the stitching on a trampoline mat often fails before the bed material. One reason stitching fails before bed material is because it is usually less UV resistant.

[0009] Another weakness with existing mats is their tendency to fray or unravel at the edges. When a trampoline is made, it is cut out of a larger sheet of material. The exposed fibers are susceptible to fraying. Fraying is often prevented by hemming the trampoline mat at the edge of the cut. Failure of the stitch used to hem the trampoline mat often results in fraying.

[0010] Finally the stitching methods used to make existing trampoline mats, increases the cost of a trampoline because of the steps that are required to construct them. For instance, many trampolines are manufactured by hand thus requiring intensive labor to manufacture the mat. In addition, the current processes for manufacturing trampoline mats cannot produce a mat with a consistent size and shape. For example, the attachment site for springs can be slightly off in various locations on the mat, which increases stress and the likelihood that the mat will fail.

[0011] Therefore, what is needed is a more durable trampoline mat that reduces localized stress in the bed fibers and can be easily and affordably manufactured.

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BRIEF SUMMARY OF THE INVENTION

[0012] The improved trampoline mat of the present invention and method of making the same overcome the problems discussed above by providing a durable mat with superior bounce. In an exemplary embodiment, the trampoline mat includes a bed and a filament. The bed is configured for jumping and performing acrobatic maneuvers.

[0013] A portion of the bed is folded over and connected to the bed to define a channel at the periphery of the bed. The filament is disposed within the channel and continues about the periphery of the bed to form a loop. A plurality of holes or notches are formed along the channel to expose portions of the filament.

[0014] The trampoline mat is configured to be connected to a trampoline frame using a plurality of coil springs. The coil springs can be attached to the mat at the exposed portions of the filament. The force of the coil springs on the filament creates a load that is distributed by the filament to the periphery of the bed.

[0015] In an exemplary embodiment, the folded portion of the bed is connected to the bed by ultrasonic welding. The ultrasonic weld is continuous with the channel that extends about the periphery of the bed. The weld uses no stitching, grommets, or webbing. Instead, the weld fuses the fibers of the outer portion of the bed to the inner portion of the bed. Since there is no stitch in the weld, there is no thread that can deteriorate and cause the trampoline mat to fail. The bed can have webbing sewn thereon for decorative or other non-load bearing purposes.

[0016] The loop formed by the filament is continuous about the periphery of the bed. The plurality of coil springs attaches to the filament and creates tension therein. The tension and continuous nature of the filament allows the filament to more evenly

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distribute the load about the periphery of the bed. Distributing the load and continuing the weld about the periphery of the bed reduces the areas of localized stress in the bed. Reducing the areas of localized stress reduces the amount of bounce that is absorbed by the mat and increases the amount of bounce that is transferred to the trampoline user. A user bouncing on the trampoline mat of the present invention will experience a better bounce because the bounce will be more powerful and more uniform about the mat. Furthermore the user can use the mat over a longer period of time at less cost because the mat is more durable.

[0017] In one embodiment, a method of making a trampoline mat is provided. The method includes cutting a piece of bed material to a desired shape, cutting notches in an outer portion of the bed, folding the outer portion and welding it to the bed using an ultrasonic welder to form a channel, and disposing a filament in the channel. The filament is connected at the ends to form a loop.

[0018] Various steps of the method of the present invention can be performed simultaneously using an automated manufacturing device. For example, the trampoline mat can be manufactured by simultaneously performing the steps of cutting the bed material, disposing the filament, folding the outer portion, and welding the outer portion to the bed. The one-step approach to manufacturing the trampoline mat of the present invention reduces manufacturing time and costs.

[0019] These and other features of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0020] To further clarify the above and other advantages and features of the present invention, a more particular description of the invention will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

[0021] Figure 1 shows an exemplary trampoline mat of the present invention attached to a trampoline frame using coil springs;

[0022] Figure 2 shows a partial bottom view of the trampoline mat, frame, and springs of Figure 1;

[0023] Figure 3 shows a cut sheet of bed material used to make the trampoline mat of Figure 1;

[0024] Figure 3A is a detail view of an edge portion of the bed material of Figure 3;

[0025] Figure 4 shows a cross-sectional view of the trampoline mat of Figure 1; and

[0026] Figure 5 shows an exemplary manufacturing system for making the trampoline mat of figure 1.

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DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0027] Exemplary embodiments of the present invention relate to an improved trampoline mat 10. As shown in Figure 1, the trampoline mat 10 includes a flexible bed 12 and a filament 14 extending about the periphery of flexible bed 12. In an exemplary embodiment flexible bed 12 and filament 14 are attached to a trampoline frame 15 using a plurality of coil springs 16.

[0028] Flexible bed 12 is formed from a sheet of flexible, durable bed material, which provides a rebounding surface on which a trampoline user can bounce or perform acrobatic maneuvers. Flexible bed 12 is shown in Figure 1 as being circular. However, flexible bed 12 may be of any desired shape including any polygon such as square, rectangular, hexagonal, octagonal, and the like. The size of flexible bed 12 can also be any desired size. Flexible bed 12 is configured to be attached to the interior of trampoline frame 15.

[0029] Generally, trampoline mat is shaped similar to trampoline frame 15 and sized smaller to accommodate springs 16. Trampoline mat 10 can be configured to work with a rigid frame, such as a metal frame, or any frame capable of suspending trampoline mat 10 over a surface. The trampoline frame 15 can be any desired material or shape and can be placed in or above the ground. Furthermore, coil springs 16 may be any type of resilient member. For instance, trampoline mat 10 can be attached to trampoline frame 15 using a plurality of elastic straps or any other device that can support the mat and return to its original position after being flexed.

[0030] The bed material used to form flexible bed 12 has properties that enhance trampoline performance and wear. For instance, in an exemplary embodiment, the bed material is lightweight thereby minimizing the amount of resilience needed by coil

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springs 16 to suspend flexible bed 12. This configuration provides a user with a better bounce. The bed material is also durable such that it will withstand the normal harsh conditions that the flexible bed 12 may be subject to. For instance, the bed material is UV resistant to prevent deterioration of the material when exposed to sunlight. In one embodiment, the bed material is polypropylene, which exhibits the foregoing properties.

[0031] Filament 14 is a cable or wire disposed in flexible bed 12 at the periphery of flexible bed 12. Filament 14 extends around flexible bed 12 and connects to itself to form a loop. The trampoline mat 10 is suspended above a surface by attaching coil springs 16 to filament 14. Filament 14 can be made of various types of material so long as the material is capable of withstanding the load applied to filament 14 when a user or users are jumping on trampoline mat 10. In one presently preferred embodiment, filament 14 consists of a vinyl covered braided steel cable having a diameter of approximately $1/8^{th}$ of an inch.

[0032] Figure 2 shows a section of the bottom outer part of flexible bed 12. Flexible bed 12 has a folded portion 18 that has been folded over and connected so as to form a channel 20 at the periphery of flexible bed 12. (Folded portion 18 includes outer portion 32 and intermediate portion 34 discussed in detail below). A plurality of notches 24 are formed in folded portion 18 so as to provide access to the interior of channel 20 at a plurality of locations spaced about the periphery of trampoline bed 10. Notches 24 may be a hole, a cutaway, or any desired shape that provides access to the interior of channel 20. Notches 24 expose filament 14 to create exposed portions 26 of filament 14. Coil springs 16 attach to filament 14 at exposed portions 26. When coil springs 16 are extended, coil springs 16 exert a load on filament 14. While filament 14 has been illustrated as a smooth loop disposed completely within channel 20, it should

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be understood, that filament 14 can be formed to have a different shape. Furthermore, portions of filament 14 disposed in channel 20 can extend outside channel 20, such as v-shaped bends that extends through notches 24.

[0033] As used herein, the terms "outer portion 32" and "outer peripheral portion 32" shall refer to a circular strip of the material (cut to the overall desired shape of trampoline bed 10 and laid out flat) from which flexible bed 12 is formed and that extends around the periphery of the material and is immediately adjacent the outer peripheral edge of the material, and which is best illustrated in Figures 3 and 3A.

[0034] As used herein, the terms "intermediate portion 34" and "intermediate peripheral portion 34" shall refer to a circular strip of the material (cut to the overall desired shape of trampoline bed 10 and laid out flat) from which flexible bed 12 is formed and that extends around the periphery of the material and is located inside of, and adjacent to, outer portion 32, and which is best illustrated in Figures 3 and 3A.

[0035] As used herein, the terms "inner portion 36" and "inner peripheral portion 36" shall refer to a circular strip of the material (cut to the overall desired shape of trampoline bed 10 and laid out flat) from which flexible bed 12 is formed and that extends around the periphery of the material and is located inside of, and adjacent to, intermediate portion 34, and which is best illustrated in Figures 3 and 3A.

[0036] The dashed lines shown in Figures 3 and 3A are for purposes of illustrating the aforementioned portions of flexible bed 12 only.

[0037] Figures 3 and 3A show an exemplary flexible bed 12 in a cut and unfolded position. In an unfolded position, flexible bed 12 has an outer peripheral portion 32, an intermediate peripheral portion 34, and an inner peripheral portion 36. In an exemplary embodiment, outer peripheral portion 32 has substantially the same radial thickness as

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inner portion 36. Outer portion 32 and inner portion 36 are substantially the same radial thickness such that outer portion 32 and inner portion form surfaces of similar width for bonding. In a folded position, outer portion 32 is folded over and bonded to inner portion 36.

[0038] Notches 24 are circular cuts formed and centered in intermediate portion 34. Centering notches 24 in intermediate portion 34 positions notches 24 to be on the fold at the outer peripheral edge, which is created when outer peripheral potion 32 is folded over and bonded to inner peripheral portion 36.

[0039] Figure 4 shows a cross-section of bed 12 in the folded and bonded position. Outer portion 32 is folded over and bonded to inner portion 36 to define channel 20 at the periphery of flexible bed 12. With outer portion 32 folded over, intermediate portion 34 lies on the periphery of flexible bed 12.

[0040] Filament 14 is disposed in channel 20. The load applied to filament 14 causes filament 14 to abut the outermost part of channel 20. Filament 14 has a sheath 28 around it to provide a protective layer between filament 14 and channel 20. Sheath 28 can be tubing or a coating that is affixed to filament 14. The sheath 28 helps prevent damage to the channel 20 by filament 14 and provides a better surface around filament 14 for attaching coil springs 16 and the like.

[0041] Outer portion 32 and inner portion 36 are bonded together to create a connected portion 22. The dashed lines representing connected portion 22 in Figure 4 are for illustrative purposes only.

[0042] The bond between outer portion 32 and inner portion 36 at connected portion 22 is strong enough to keep outer portion 32 and inner portion 36 from separating when trampoline mat 10 is in use. In an exemplary embodiment, outer portion 32 is

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connected to inner portion 36 by ultrasonic welding. When outer portion 32 is connected to inner portion 36 using ultrasonic welding, the fibers of the two layers of soften and/or melt together to form bonded fibers. Since outer portion 32 is connected to inner portion 36 using ultrasonic welding, flexible bed 12 has no stitching, grommets, or webbing that bears a substantial portion of the load.

[0043] In a trampoline bed that uses connection means such as stitching, grommets, or webbing, the connection means bears a substantial portion of the load if when it deteriorates, the deterioration creates a weak spot in the bed where the trampoline mat 10 fails to support the load. In other words, sewn stitching, grommets or webbing that are aesthetic, or integrated purely for purposes of attaching something other than the filament and/or coil springs and the like, is not a portion of the bed that bears a substantial portion of the load. The failure of these portions would not affect the integrity of the mat with respect to the load applied by the coil springs.

[0044] In another embodiment, outer portion 32 is connected to inner portion 36 using a different type of thermal joining, or adhesive. In yet another embodiment, folded portion 18 is connected to flexible bed 12 by sewing a stitch. Stitching the fold in some cases can be beneficial since sewing can be relatively inexpensive. In addition, some bed materials are not suitable for thermal joining and thus cannot be connected using a thermal weld.

[0045] Outer portion 32 is shown folded under inner portion 36 in Figure 3. Folding outer portion 32 under flexible bed 12, instead of over flexible bed 12, provides a smooth upper bouncing surface for users. However, trampoline mat 10 of Figure 3 is capable of being attached to trampoline frame 15 with either side up. In other

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embodiments, the trampoline mat may be capable of only attaching with the top surface up and may have the outer portion folded under or over flexible bed 12.

[0046] In one type of use, trampoline mat 10 is attached to trampoline frame 15 using coil springs 16. Trampoline frame 15 and coil springs 16 suspend flexible bed 12 over a surface so a user can bounce thereon or perform other acrobatic maneuvers. In use, a user on trampoline mat 10 uses his or her weight to flex the trampoline mat 10 downward.

[0047] A user bouncing on trampoline mat 10 causes coil springs 16 to expand. As coil springs 16 expand, a force is applied to filament 14. Filament 14 is continuous such that the resilient force of coil springs 16 creates a distributed load through filament 14. In addition, channel 20 and connected portion 22 are continuous about the periphery. Because of the continuous nature of channel 20 and connected portion 22 the load distributed by filament 14 is more evenly distributed across flexible bed 12. The evenly distributed load in flexible bed 12 reduces localized areas of strain or bias in the bed material.

[0048] The ability of the trampoline mat 10 to transfer energy more evenly about the periphery of flexible bed 12 gives trampoline mat 10 a better bounce. Furthermore, distributing the load about filament 14 increases the durability of trampoline mat 10 since diminishing localized areas of strain decreases the likelihood that flexible bed 12 will fail at an area of localized strain.

[0049] The improved elements found in trampoline mat 10 enable it to be efficiently manufactured. An exemplary trampoline mat 10 is made by first cutting a sheet of bed material to form flexible bed 12 in an unfolded position. (Fig. 3) Notches 24 are cut into outer peripheral portion 36 such that when outer peripheral portion 36 is folded

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over and connected to inner peripheral portion 34, the notches 24 will be formed in the resulting outer peripheral edge of the fold.

[0050] Filament 14 is then disposed on outer peripheral portion 36 over notches 24. Outer peripheral portion 36 is folded over filament 14 and connected to inner peripheral portion 34 using an ultrasonic welder. Ultrasonic welding fuses the overlapping double layers to form connected portion 22 having bonded bed material fibers. Notches 24 expose portions 16 of filament 14. (Fig. 2)

[0051] In an exemplary embodiment, filament 14 is connected to form a loop. In one version of trampoline mat 10, the ends of filament 14 are crimped together to form the loop. In another version, the ends of filament 14 are connected by overlapping the ends and securing one or both of the ends to filament 14. The particular order in which the step of disposing filament 14 is performed is not critical. For instance, filament 14 may be disposed in flexible bed 12 before or after peripheral outer portion 36 is folded over and connected to inner peripheral portion 34. The order in which notches 24 are cut is also not critical. For instance, notches 24 can be cut before or after the bed material is cut to the desired shape.

[0052] In an exemplary embodiment, fibers in the bed material benefit from the ultrasonic cutting or plasma cutting. When the bed material is cut by other means such as scissors or purely mechanical cutting mechanisms, the fibers at the edge of the cut are susceptible to fraying. However, by using an ultrasonic cutter or a plasma cutter, cutting the bed material also results in the fibers at the edge of the cut being bonded together. As the ultrasonic cutter or plasma cutter cuts the material, adjacent fibers on the edge of the bed material are bonded together. This bonding, prevents the cut edges

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from fraying, thereby increasing the durability of the material. Fraying can also be prevented by applying a heat treatment to the cut edge.

[0053] Figure 5 shows an exemplary manufacturing apparatus 40 for performing the foregoing method of manufacturing the trampoline mat 10. A bulk roll 42 contains a roll of uncut bed material 44. The uncut bed material 44 is spread out and fed onto vacuum platen 46. A take-up roll pulls the scrap material across the vacuum platen 46 and a scrap shear cuts scrap bed material and drops it on conveyor 58. Conveyor 58 moves scraps to the hopper 60.

[0054] A process device 48 is configured to perform cutting and welding operations. Process device 48 rotates about an axis at the center of the vacuum platen 46 and can rotate both clockwise and counterclockwise. Process device 48 has a cutter 50, such as a plasma cutter and/or ultrasonic cutter, at an end thereof. The cutter 50 can move horizontally along an arm 49 of process device 48.

[0055] The horizontal movement of the cutter 50 on arm 49 and the circular movement of process device 48 enables cutter 50 to cut any desired shape inside the maximum circumference of process device 48. For instance, the cutter 50 may cut the uncut bed material 44 in the shape of a circle or any polygon such as a square, rectangle, octagon, etc.

[0056] Process device 48 also has a welder (not shown), such as an ultrasonic welder, which is capable of moving horizontally on arm 49. Similar to the cutter 50, the welder can weld any shape by moving annularly and horizontally. In one embodiment process device 48 has separate heads for welding and cutting, thus cutter 50 moves independent of the welder. In another embodiment, the cutter 50 and welder are a single unit.

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[0057] In another version of the invention, process device 48 may move in both planar directions using a mechanism other than rotating about an axis. For instance, the process device could move linearly in both directions on a pair of guides.

[0058] Process device 48 also feeds filament 14 from a reel of filament 54. The filament 14 may be fed through the center of process device 48 such that process device 48 can rotate without entangling filament 14. Process device 48 may also be configured to fold outer portion 36.

[0059] In one embodiment, manufacturing apparatus 40 performs the following steps substantially simultaneously as process device 48 rotates about the axis: (i) process device 48 cuts uncut material 44, (ii) feeds filament 14 from reel 54 and disposes filament 14 on outer peripheral portion 36, (iii) folds outer portion 36, and (iv) connects outer peripheral portion 36 to inner peripheral portion 34 by ultrasonic welding. In this embodiment, cutter 50 and welder 52 operate substantially simultaneously to perform the various steps.

[0060] In another embodiment, cutter 50 and welder 52 form a single head for performing operations. In this embodiment, the steps of cutting and welding are performed at different instances. However, performing any or all of the foregoing steps simultaneously can reduce manufacturing time and costs.

[0061] In an exemplary embodiment, the steps for making the improved trampoline mat are automated and computer controlled. A microprocessor precisely controls the cutting, folding and welding of trampoline mat 10 by controlling the movement of process device 48, cutter 50, and the welder. Because the manufacturing of trampoline mat 10 is precisely controlled, trampoline mat 10 has a uniform and consistent size and

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shape. Irregularities that cause stress in the prior art trampolines is reduced or nearly eliminated with the process of the present invention.

[0062] The foregoing process also allows easy repairs to be performed in the field, a benefit not available to prior methods of manufacturing and repairing trampoline mats. Finally, trampoline mat 10 produced according to methods of the present invention reduces manufacturing costs because it uses less raw materials. The precise manufacturing and unique process produces a trampoline mat with much less waste than the prior processes known in the prior art. As a result, the process of the present invention can produce trampoline mat more cost effectively.

[0063] The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

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